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FIBERIZING AND PAD FORMING APPARATUS

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FIBERIZING AND PAD FORMING APPARATUS

Abstract of the Disclosure

Apparatus for fiberizing a sheet of wet-pressed pulp fibers into individual fibers and forming individual, spaced-apart pads of such fibers, as follows. A generally enclosed, stationary chamber is provided which has an open bottom end and a slot in an upper portion to receive a sheet of wet-pressed pulp fibers. A driven fiberizing device is rotatably mounted in the upper portion of the chamber for fiberizing the sheet into substantially individual fibers. A longitudinally moving conveyor belt having longitudinally-spaced groups of small perforations therein along the length thereof corresponding to the desired configuration and spacing of the fiber pads being formed is positioned for movement along the open bottom end of the chamber directly below the fiberizing device for cooperating with the chamber for forming an enclosed pad forming area in a lower portion of the chamber and for receiving the fiberized fibers on its upper surface and conveying the fiberized fibers out of the chamber. A stationary vacuum device is positioned at the lower surface of the belt and directly below the

chamber for creating a vacuum through
the groups of perforations in the moving
belt for causing the fibers to be pulled
to the groups of perforations for forming
individual, spaced-apart pads on the
moving belt over the groups of perforations
and within the lower portion of the chamber
for being conveyed by the belt out of the
chamber after formation thereof.

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THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. Apparatus for forming individual, spaced-apart pads of fibers said apparatus comprising: generally enclosed, stationary chamber means having an open bottom; means for supplying individual fibers into an upper portion of said chamber means; driven, longitudinally moving conveyor belt means having longitudinally-spaced groups of small perforations therein along the length thereof corresponding to the desired configuration and spacing of the fiber pads being formed and being positioned for movement along said open bottom end of said chamber means and cooperating with said chamber means for forming an enclosed pad forming area in a lower portion of said chamber means and for receiving the individual fibers on its upper surface and conveying the individual fibers out of said chamber means vacuum means positioned at the lower surface of said belt means and directly below said chamber means for creating a vacuum through said groups of perforations in said moving belt means for causing said fibers to be pulled to said groups of perforations to form individual, spaced-apart pads on said moving belt means over said groups of perforations and within said lower portion of said chamber means for being conveyed by said belt means out of said chamber means after formation thereof.
2. Apparatus for dry fiberizing a sheet of pulp fibers into individual fibers and forming individual, spaced-apart pads of such fibers; said apparatus comprising: generally enclosed, stationary chamber means having an open bottom and a slot in an upper portion thereof to receive a sheet of pulp fibers; driven fiberizing means rotatably mounted in the upper portion of said chamber means for fiberizing the sheet of pulp fibers into substantially individual fibers; driven, longitudinally moving conveyor belt means having longitudinally-spaced groups of small perforations therein along the length thereof corresponding to the desired configuration and spacing of the fiber pads being formed and being positioned for movement along said open bottom end of said chamber means directly below said fiberizing means and cooperating with said chamber means for forming an enclosed pad forming area in a lower portion of said chamber means.

ber means and for receiving the fiberized fibers on its upper surface and conveying the fiberized fibers out of said chamber means; and vacuum means positioned at the lower surface of said belt means and directly below said chamber means for creating a vacuum through said groups of perforations in said moving belt means for causing said fibers to be pulled to said groups of perforations to form individual, spaced-apart pads on said moving belt means over said groups of perforations and within said lower portion of said chamber means for being conveyed by said belt means out of said chamber means after formation thereof.

3. Apparatus, as set forth in claim 1 or claim 2, further including air conduit means connected to opposed longitudinal ends of said lower portion of said chamber means for creating a flow of turbulent air through said lower portion of said chamber means in a longitudinal direction opposite to the movement of said belt means to cause the fiberized fibers to settle on said moving belt means substantially only over said groups of perforations and to pick up and remove the fiberized fibers settling in the spaces between said groups of perforations and re-circulate these fibers to said pad forming area of said chamber means.

4. Apparatus, as set forth in claim 1 or claim 2, further including air conduit means connected to opposed longitudinal ends of said lower portion of said chamber means for creating a flow of turbulent air through said lower portion of said chamber means in a longitudinal direction opposite to the movement of said belt means to cause the fiberized fibers to settle on said moving belt means substantially only over said groups of perforations and to pick up and remove the fiberized fibers settling in the spaces between said groups of perforations and re-circulate these fibers to said pad forming area of said chamber means, in which said air conduit means comprises a continuous, elongate, enclosed conduit having opposite open ends connected with the opposed longitudinal ends of said lower portion of said chamber means and a fan means interposed in said conduit intermediate said ends for creating a positive air stream through a portion of said conduit and out of one of said ends and into said chamber means and a negative air stream through another

portion of said conduit and into the other of said ends from said chamber means.

5. Apparatus, as set forth in claim 2, further including a pair of driven nip rolls positioned adjacent said sheet receiving slot in said chamber means for receiving the sheet of wet-pressed pulp fibers therebetween and feeding the sheet into said chamber means.

6. Apparatus, as set forth in claim 2, further including a driven roll mounted in a front portion of said chamber means adjacent the top surface of said conveyor belt means and rotating in the longitudinal direction of movement of said conveyor belt for cooperation with said chamber means and belt means for enclosing said pad forming area and for cooperating with said belt means for conveying the pads out of said chamber means.

7. Apparatus, as set forth in claim 1 or claim 2, in which said conveyor belt means comprises an endless belt and a pair of driven rolls positioned within said belt at each end thereof for carrying and driving said belt, and in which said belt includes additional spaced perforations extending along the longitudinal edges thereof and one of said rolls includes spaced projections extending outwardly around the circumference thereof at each end thereof for mating with said additional perforation in said belt for synchronizing the speed of said belt with the speed of said roll.



FIBERIZING AND PAD FORMING APPARATUS

This invention relates to apparatus for fiberizing a sheet of wet-pressed, pulp fibers into individual fibers and forming individual, spaced-apart pads of such fibers.

In the manufacture of sanitary products, particularly disposable diapers and sanitary napkins, an absorbent pad of fiberized fibers is often utilized as the absorbent interior core of such products. These fiberous pads have been formed by various and sundry devices and normally require fiberizing of a wet-pressed sheet of such fibers into individual fibers and then forming individual pads of such fibers by air-laying methods or otherwise. These operations are necessitated by the fact that the fiberous material is normally produced by the fiber manufacturers in the form of wet-pressed sheets for ease in shipping and handling and must then be fiberized by the sanitary products manufacturer into individual fibers and then these individual fibers formed into individual pads of such fiberized fibers for use in fabricating of the sanitary products.

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It has been the normal practice to perform the above operation in two stages and, usually, with separate machines. The sheets of wet-pressed pulp fibers would be fiberized by one machine and then conveyed by air or the like to an air-laying, pad forming machine. These operations have presented numerous problems in proper handling and conveying of the fiberized fibers to the air-laying, pad forming devices and in the production of a uniform pad of such fiberized fibers.

The air-laying equipment normally utilized in these operations produces a continuous strip of air-laid fibers which requires the removal of small, spaced-apart segments



of the strip to form individual pads after the fibers have been air-laid. This requires additional operation steps and equipment for removal of these segments which is also undesirable and time consuming in the manufacturing operation.

It has also been proposed to utilize fiberizing and air-laying equipment in conjunction with sanitary products fabricating machines, such as disclosed in United States Patent 3,661,680, issued May 9, 1972, and assigned to the assignee of the present invention. In this disposable diaper fabricating machine, wet-pressed sheets of fibers are fiberized in a device adjacent to the disposable diaper fabricating machine and pneumatically conveyed to an air-laying mechanism on the machine for forming a continuous strip of fibers onto movable conveyors forming part of the diaper fabricating machine and, if desired, onto other sheets of material utilized in the disposable diapers. After formation of the continuous strip of fiberized fibers, it was required to remove successive, spaced-apart segments of the strip for formation of individual pads to constitute the interior core of successively formed disposable diapers.

Accordingly, it is the object of this invention to provide improved apparatus for fiberizing a sheet of wet-pressed, pulp fibers into individual fibers and forming individual, spaced-apart pads of such fibers which overcomes the disadvantages and problems presented with prior known devices.

It is a further object of this invention to provide a fiberizing and pad forming apparatus which eliminates the necessity for pneumatically conveying the fiberized fibers from a fiberizing device to a pad forming device.

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It is a further object of this invention to provide a pad forming apparatus which will form spaced-apart pads of individual fibers without the necessity of first forming a continuous strip of fibers and then removing spaced segments of fibers to form individual pads, and to form uniform, evenly distributed fibrous pads.

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It has been found by this invention that the above objects may be accomplished by providing apparatus comprising generally enclosed, stationary chamber means having an open bottom including means for supplying individual fibers into an upper portion of the chamber means. Driven, longitudinally moving conveyor belt means having longitudinally-spaced groups of small perforations therein along the length thereof corresponding to the desired configuration and spacing of the fiberous pads being formed is positioned for movement along the open bottom end of the chamber means for cooperating with the chamber means for forming an enclosed pad forming area in a lower portion of the chamber means for receiving the individual fibers on its upper surface and conveying the individual fibers out of the chamber means. A stationary vacuum means is positioned at the lower surface of the belt means and directly below the chamber means for creating a vacuum through the groups of perforations in the moving belt means for causing the fibers to be pulled to the groups of perforations to form individual, spaced-apart pads on the moving belt means over the groups of perforations and within the lower portion of the chamber means for being conveyed by the belt means out of the chamber means after formation thereof.

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Preferably, the means for supplying individual fibers into an upper portion of the chamber means includes a slot

in the upper portion of the chamber means to receive a sheet of wet-pressed pulp fibers and a rotatably mounted and driven fiberizing means mounted in the upper portion of the chamber means for contacting the sheet of wet-pressed pulp fibers and fiberizing the sheet into substantially individual fibers. The fiberizing means is mounted directly over the longitudinally moving conveyor belt means and the vacuum means so that the fiberized fibers will fall directly onto the moving belt without the necessity of pneumatic conveyance of the fibers from the fiberizing means to the pad forming means.

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Preferably, an air conduit means is connected to opposed longitudinal ends of the lower portion of the chamber means for creating a flow of turbulent air through the lower portion of the chamber means in a longitudinal direction opposite to the movement of the belt means to cause the individual fibers to settle on the moving belt means substantially only over the groups of perforations and to pick up and remove the fiberized fibers settling in the spaces between the groups of perforations and re-circulate these fibers to the pad forming area of the chamber means.

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With this arrangement, evenly distributed individual fibrous pads are formed which do not have fibers between the pads and which have uniform dimensions and which eliminate the necessity of the complicated equipment heretofore needed for formation of such spaced-apart individual pads of uniform dimensions.

Some of the objects and advantages of this invention having been stated, other objects and advantages will appear as the description proceeds when taken in conjunction with the accompanying drawings, in which --

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Figure 1 is a schematic perspective view of the fiberizing and pad-forming apparatus of this invention;

Figure 2 is a cross-sectional, elevational view, taken generally along the line 2-2 of Figure 1;

Figure 3 is a cross-sectional, elevational view, taken generally along the line 3-3 of Figure 1;

Figure 4 is a perspective view of the conveyor belt means of the apparatus of Figures 1-3 illustrating the groups of perforations therein for formation of individual, spaced-apart fiberous pads; and

10 Figure 5 is a view, like Figure 4, illustrating the fiberous pads after formation on the conveyor belt.

Referring now the drawings and with respect to the improved fiberizing and pad forming apparatus of this invention it is to be understood that this fiberizing and pad forming apparatus may be utilized either alone for fiberizing a sheet of wet-pressed pulp material into individual fibers and forming of the fibers into individual spaced-apart pads, or may be used directly in conjunction with a sanitary products fabricating machine, such as disclosed in the above identified United States Patent 3,661,680, where the apparatus would be placed directly in the disposable diaper fabricating machine for forming spaced-apart fiberous pads directly onto sheets of material utilized in the forming of the disposable diapers. Also, it is to be understood that the improved pad forming mechanisms of the apparatus of this invention may be utilized separate from the fiberizing devices for forming individual spaced apart pads of fibers in which the individual fibers are received therein from any suitable source.

30 The apparatus for fiberizing a sheet S of wet-pressed pulp fibers into individual fibers F and forming individual, spaced-apart pads P of such fibers F comprises

the following. A stationary housing 10 forms a generally enclosed chamber and includes an open bottom 11 and a slot 12 in an upper portion thereof to receive the sheet S of wet-pressed wood pulp fibers. If desired, the slot 12 may include guide lips 13 protruding outwardly therefrom for receiving and guiding the sheet S into the slot 12 and into the upper portion of the chamber formed by the housing 10.

Also, a pair of driven nip rolls 15 may be suitably mounted adjacent the slot 12 in the housing 10 and the lips 13 for receiving the sheet S of fibers therebetween and feeding the sheet S into the slot 12 and into the upper portion of the chamber formed by the housing 10. These nip rolls 15 may be suitably driven through sprocket gears 16 by any suitable drive mechanism (not shown) including a motor driven, pulley-belt arrangement, etc.

Within the upper portion of the chamber formed by the housing 10, there is rotatably mounted a fiberizing device 20 for contacting the sheet S of wet-pressed pulp fibers and fiberizing the sheet S into substantially individual fibers F. The fiberizing device 20 may comprise a generally cylindrical-shaped roll having teeth 21 (see Figure 3) around the outer circumference thereof for contacting the sheet S of wet-pressed pulp fibers and breaking the sheet into substantially individual fibers F. This cylindrical roll fiberizing device 20 may be in the form of a plurality of cylindrical discs 22 (see Figure 2) which are mounted in side-by-side relationship on a support shaft 23 and include teeth 21 around the outer periphery or circumference of each of the discs 22. The support shaft 23 is suitably carried by bearing rolls 24 in a bearing housing 25 at each end of the housing 10 forming the fiberizing and pad forming chamber.

The fiberizing device 20 may be driven by any suitable drive means including a pulley and belt device 26 which is driven from any suitable motor or other drive means (not shown). The fiberizing cylinder 20 is driven in the direction of the arrows shown in Figure 3 so that the teeth 21 will contact the end of the sheet S of wet pressed pulp fibers and break the sheet S into individual fibers F, (see Figure 3) which will fall by gravity flow from the upper portion of the chamber defined by housing 10 to the lower portion of the chamber.

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A driven, longitudinally moving conveyor belt 30 is positioned for movement along the open bottom end of the chamber defined by the housing 10 directly below the fiberizing device 20 for cooperating with the housing 10 and chamber formed thereby for forming an enclosed pad forming area in the lower portion of the chamber defined by the housing 10. The conveyor belt 30 receives the individual fiberized fibers F on its upper surface and conveys these fiberized fibers F out of the chamber defined by the housing 10.

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The conveyor belt 30 is in the form of a continuous, endless, elongate belt mounted on a pair of driven rolls 32 positioned within the belt 30 at each end thereof for carrying and driving the belt. One of the rolls 32 (see Figure 1) is driven by any suitable drive arrangement including a ratchet and chain device 33 driven from any suitable drive means. It is desirable to coordinate the drive of the conveyor belt 30 with the drive of the nip rolls 15 so that the speed of feed of the wet-pressed pulp sheet S into the chamber defined by the housing 10 will be coordinated with the speed of movement of the conveyor belt for forming the desired pads of fibers, to be explained below. Accordingly, the drive for the conveyor

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belt drive roll 32 and the drive for the nip rolls 15 may be interconnected, or if the fiberizing and pad forming device of this invention is utilized in connection with a sanitary products fabricating machine such as disclosed in the above identified United States Patent 3,661,680, these drives for the conveyor belt drive rolls 32 and the wet-pressed pulp sheet feed nip rolls 15 may be connected with suitable drives for the disposable diaper fabricating machine.

10 The conveyor belt 30 includes longitudinally-spaced groups of small perforations 35 along the length thereof which correspond to the desired configuration and spacing of fiber pads P to be formed. As may be seen more clearly in Figure 4, these longitudinally-spaced groups of perforations 35 in the conveyor belt 30 are generally rectangular for forming generally rectangular fiberized fiber pads P.

20 The belt 30 further includes additional spaced perforations 36 extending generally in a straight line along the longitudinal edges of the belt 30 and one of the drive rolls 32 includes spaced projections 37 extending outwardly around the circumference thereof at each end thereof for mating with the additional perforations 36 in the belt 30 for synchronizing the speed of the belt 30 with the drive roll 32. This arrangement of perforations 36 and mating projection 37 prevents any slipping between the drive roll 32 and the conveyor belt 30.

30 A stationary vacuum device 40 is positioned at the lower surface of the conveyor belt 30 and directly below the chamber defined by the housing 10 for creating a vacuum through the groups of perforations 35 in the moving belt 30 for causing the fiberized fibers F as they fall by gravity flow from the fiberizing device 2^a to be pulled to the groups of perforations

35 to form individual, spaced-apart pads P on the moving belt
30 over the groups of perforations 35 and within the pad
forming area in the lower portion of the chamber defined by
the housing 10 for being conveyed by the belt 30 out of the
chamber after formation of the individual, spaced-apart pads P.

The vacuum device 40 may be in the form of an open-top hood 41 which has a length generally corresponding to
and somewhat exceeding the length of the chamber formed by
the housing 10 and having a width generally corresponding
10 to the width of the conveyor belt 30 and the lower portion
of the chamber defined by the housing 10 for creating a
vacuum or negative air flow through the groups of perforations
35 in the moving conveyor belt 30 as these groups of
perforations 35 pass along the open bottom end of the housing
10 and the lower portion of the chamber defined thereby so as
to successively form spaced-apart individual pads P of
fiberized fibers over the groups of perforations 35 as they
pass along the open bottom end of the housing 10 and the lower
portion of the interior chamber defined thereby. The hood 41
20 is connected by a conduit 42 to any suitable source of
negative air pressure or vacuum so as to cause a negative
air flow therethrough (as indicated by the arrows in Figure 3).

There is provided a continuous, elongate, enclosed
air conduit 50 having opposite open ends 51 and 52 connected
with opposed longitudinal ends of the lower portion of the
chamber defined by the housing 10 (as shown in Figure 2). A
motor driven fan 54 is interposed in the conduit 50 intermediate
the ends 51, 52 for creating a positive air stream through a
portion of the conduit 50 and out of the end 51 and into the
lower portion of the chamber defined by the housing 10 and
30 a negative air stream through the other portion of the conduit

50 and into the other end 52 from the lower portion of the chamber defined by the housing 10.

This creates a flow of turbulent air (as indicated by the arrows in Figure 2) through the pad forming area in the lower portion of the chamber defined by the housing 10 in a longitudinal direction opposite to the direction of movement of the belt 30 to cause the fiberized fibers F to settle on the moving belt 30 substantially only over the groups of perforations 35 and to pick up and remove fiberized fibers F settling in spaces between the groups of perforations 35 on the belt 30 and re-circulate these fibers through the conduit 50 by pulling these loose fibers F into the end 52 of the conduit 50, through the conduit 50 and out of the end 51 back into the pad forming area in the lower portion of the chamber defined by the housing 10. This flow of turbulent air provides an even distribution of the fiberized fibers F onto the groups of perforations 35 in the moving belt 30 so as to form evenly distributed and evenly dimensioned pads P over the groups of perforations 35 and prevents any of the fibers F from positioning themselves in the spaces between the thus formed pads P.

For cooperating with the belt 30 for conveying the thus formed pads P out of the pad forming area in the lower portion of the chamber defined by the housing 10, there is provided a driven roll 60 suitably rotatably mounted in an opening in the front portion of the housing 10 and the chamber formed thereby and adjacent the top surface of the conveyor belt 30 for cooperation with the housing 10 and the belt 30 for enclosing the pad forming area in the lower portion of the chamber defined by the housing 10. The roll 60 may be driven by sprocket gears 61 and ratchet and

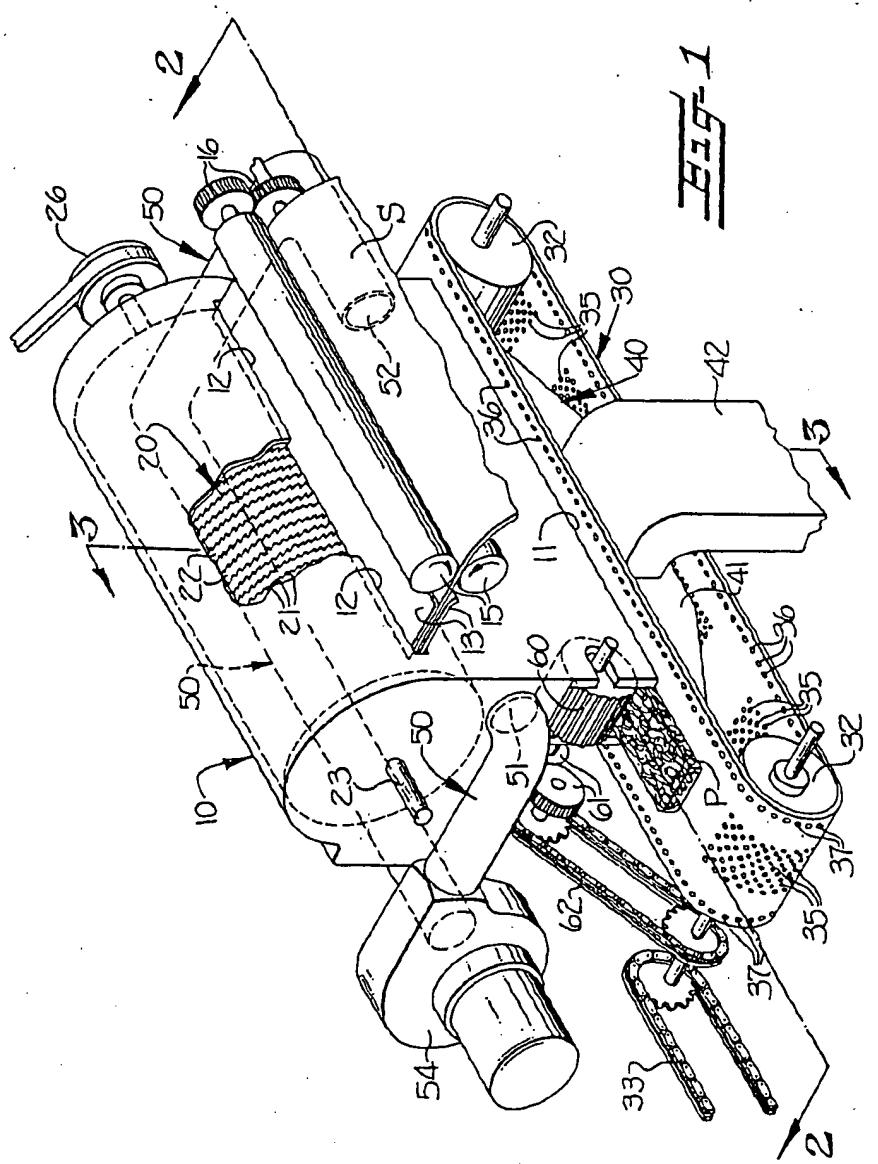
chain device 62 from the drive shaft of the conveyor belt drive roll 32 so that rotation of the roll 60 will be coordinated with the speed of movement of the conveyor belt 30 for causing a slight squeezing action on the pads P and cooperating with the belt 30 for conveying the pads P out of the pad forming area in the lower portion of the chamber defined by the housing 10.

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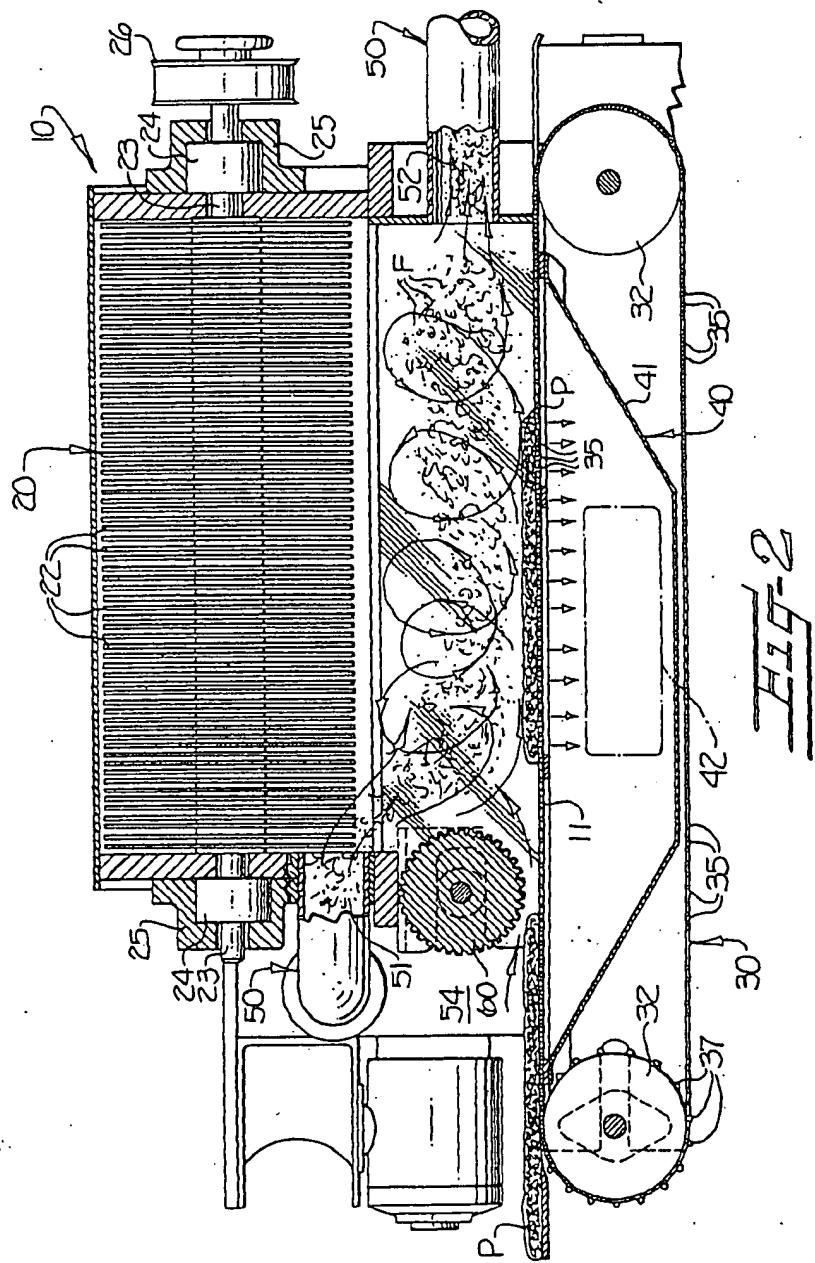
Thus it may be seen, that the fiberizing and pad forming apparatus of this invention has provided a simple mechanism which will form individual, spaced-apart pads of fiberized fibers which have been fiberized from a wet-pressed sheet and which eliminates the problems and undesirable features of prior mechanisms. If desired, the pads of fiberized fibers may be formed directly on a sheet of material, which can be fed onto the conveyor in advance of the fiberizing and pad forming chamber, and the vacuum created through the perforations in the conveyor belt will also be created through this sheet material. The pads, whether formed on a sheet of material or not, may be conveyed by the conveyor onto another conveyor, or otherwise, as desired, for use in fabricating of sanitary products or other uses.

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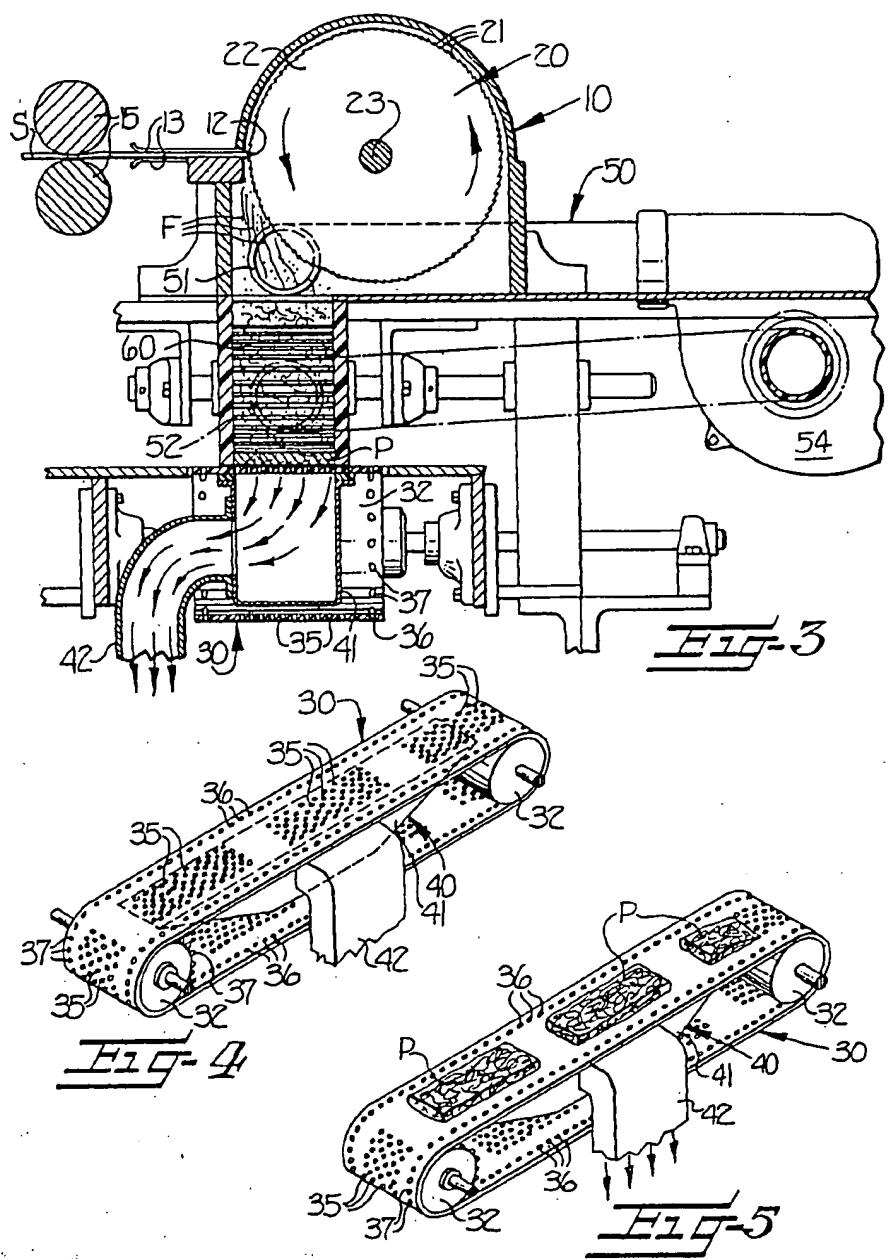
In the drawings and specification, there has been set forth a preferred embodiment of this invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation.



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